

**CLAIM AMENDMENTS**

This listing of claims will replace all prior versions and listings of claims in the application.

**Listing of Claims**

- 1           1.       (Currently Amended) A redundant hub-spoke configuration for a virtual  
2 private LAN (VPN) of the type having a plurality of emulated LANs (ELANs), each  
3 connected at a provider edge (PE) node over a service provider network, comprising:  
4           a first hub node serving client equipment (CE) devices connected on a first ELAN,  
5           a spoke node serving CE devices on a second ELAN;  
6           a first point-to-point link L1 for interconnecting said first hub node and said spoke  
7 node; and  
8           a second hub node interconnected with said first hub node,  
9           wherein whenever said first link L1 fails, said second hub node establishes  
10 communication with said spoke node over a second point-to-point link L2.
- 1           2.       (Currently Amended) The redundant hub-spoke configuration of claim 1,  
2 wherein said second hub node operates as a spoke node of first said hub node under normal  
3 operation conditions.
- 1           3.       (Original) The redundant hub-spoke configuration of claim 1, wherein said  
2 first hub node operates as a spoke node of said second hub node when said first hub node  
3 fails.
- 1           4.       (Original) The redundant hub-spoke configuration of claim 1, wherein a first  
2 PE node interfacing said first hub with said service provider network monitors said first link  
3 L1 for detecting a failure at said hub node.  
4
- 1           5.       (Currently Amended) The redundant hub-spoke configuration of claim 1,  
2 wherein in case of a failure at said first hub node, said first PE node signals to a third PE

3 node interfacing said spoke node with said service provider network to establish a second  
4 point-to-point link with said second hub node, and to re-map the traffic from said second hub  
5 node over said second point-to-point link.

1 6. (Original) The redundant hub-spoke configuration of claim 1, wherein the  
2 access link between said spoke node and said third PE node is an aggregated bundle of links  
3 comprising a redundant link.

1 7. (Original) The redundant hub-spoke configuration of claim 6, wherein  
2 connectivity between said third PE node and said spoke node is maintained when a link on  
3 said respective aggregated bundle is interrupted.

1 8. (Original) The redundant hub-spoke configuration of claim 7, wherein the  
2 loss of a link in said aggregated bundle is transparent to said spoke node.

1 9. (Original) In a hub-spoke configuration for a virtual private LAN (VPN) of  
2 the type having a plurality of emulated LANs (ELANs), each connected at a service provider  
3 edge (PE) node over an access link, a method for recovering the traffic in case of a failure,  
4 comprising:

5 a) transmitting traffic from a first hub node to a spoke node over a first point-to-point  
6 link established between a first PE at said first hub node and a third PE at said spoke node;

7 b) at said third PE, monitoring the traffic on said first link;

8 c) responsive to a fault on said link, signaling said fault from said third PE to said first  
9 PE; and

10 d) transmitting traffic from a second hub node to said spoke node over a second  
11 point-to-point link established between a second PE node at said second hub node and said  
12 third PE.

1 10. (Original) The method of claim 9, wherein step a) comprises:

2 at said first hub node, bridging the traffic destined to said spoke node towards said  
3 first PE;

4 at said first PE, tunneling the traffic received from said first hub node along said  
5 point-to-point connection to said third PE,  
6 at said third PE, mapping the traffic received over said point-to-point connection to  
7 said spoke node; and  
8 at said spoke node, bridging the traffic received from said third PE.

1 11. (Original) The method of claim 9, wherein step a) comprises:  
2 at said second hub node, bridging the traffic destined to said spoke node towards said  
3 third PE;  
4 at said second PE, tunneling the traffic received from said second hub node along said  
5 second point-to-point connection to said third PE,  
6 at said third PE, mapping the traffic received over said second point-to-point  
7 connection to said spoke node; and  
8 at said spoke node, bridging the traffic received from said third PE.

1 12. (Original) The method of claim 9, wherein said step c) comprises using a  
2 Layer1 signaling protocol.

1 13. (Original) The method of claim 9, wherein said second hub node operates as  
2 a spoke node of said first hub node under normal operation conditions.

1 14. (Original) The method of claim 9, wherein said first hub node operates as a  
2 spoke node of said second hub node when said hub node fails.

1 15. (Original) The method of claim 9, wherein first and second point-to-point  
2 connections are point-to-point Ethernet tunnels.

1 16. (Original) The method of claim 9, wherein the access link between said third  
2 PE and said spoke is an aggregated bundle of links comprising a redundant link.

1           17.     (Original) The method of claim 16, wherein connectivity between third PE  
2     node and said spoke node is maintained when a link on said aggregated bundle is interrupted.

1           18.     (Original) The method of claim 17, wherein the loss of a link in said  
2     aggregated bundle is transparent to said spoke node.

1           19.     (Withdrawn) A method of providing a multipoint emulated LAN connecting  
2     a plurality of sites with site-to-site bandwidth guarantees, comprising:  
3                 configuring a second customer located equipment PLE to perform multipoint  
4     switching of the traffic in a first VC/tunnel established between a first site and said second  
5     site, to one of a second or a third site, based on the MAC address;  
6                 configuring a first CLE to operate as a spoke of said first CLE to perform point-to-  
7     point switching of said first VC/tunnel, and of a second VC/tunnel established between said  
8     third site and said second site; and  
9                 allocating a first bandwidth to said first VC/tunnel and a second bandwidth to said  
10    second VC/tunnel and rate limiting traffic in each said first VC/tunnel and said second  
11    VC/tunnel to said respective allocated bandwidth.

1           20.     (Withdrawn) In a virtual private LAN (VPL) of the type having a plurality of  
2     emulated LANs, each emulated LAN comprising an access device connected to a service  
3     provider edge PE node along an access link identified by a data link connection identifier,  
4     and a first PE is interconnected with a second PE along a point-to-point link, a method of  
5     establishing a hybrid connection between a first customer equipment CE device on said VPL  
6     and a second CE device that operates according to a different communication protocol, said  
7     method comprising:  
8                 a) at said second CE device, performing bridged encapsulation of the traffic and  
9     transmitting a second type protocol data unit (PDU) over a second access link to a second  
10    provider edge (PE) node;  
11                 b) at said second PE node, decapsulating traffic from said PDU, and transmitting the  
12    traffic into a service provider type PDU over a dedicated point-to-point tunnel across said  
13    service provider network to a first PE node;

11           b) at said second PE node, decapsulating traffic from said PDU, and transmitting the  
12 traffic into a service provider type PDU over a dedicated point-to-point tunnel across said  
13 service provider network to a first PE node;

14           c) at said first PE node, decapsulating the traffic from said service provider PDU,  
15 converting it to a first type PDU and transmitting said PDU to a first access device over a  
16 first access link;

17           d) at said first access device, bridging said PDU to said first CE device.

1           21.   (Withdrawn) The method of claim 20, wherein said first access link is  
2 differentiated at said first access device by a dedicated first data link connection identifier  
3 DCLI, and said second access link is differentiated at said second PE node by a dedicated  
4 second DCLI.

1           22.   (Withdrawn) In a VPL of the type having a plurality of emulated LANs, each  
2 emulated LAN comprising an access link to a service provider edge PE node identified by a  
3 data link connection identifier, a method of establishing a hybrid connection between a first  
4 customer equipment CE device on said VPL and a second CE device that operates according  
5 to a different communication protocol, said method comprising:

6           a) at said first CE device, bridging a first type PDU to a first PE node over a first  
7 access link;

8           c) at said first PE node, decapsulating traffic from said first type PDU, encapsulating  
9 the traffic into a service provider type PDU and transporting it over a dedicated point-to-  
10 point tunnel across said service provider network to a second PE node; and

11           d) at said second PE, decapsulating traffic from said service-provider PDU,  
12 performing bridged encapsulation of the traffic in a second type PDU and sending it to said  
13 second CE device over a second access link.

1           23.   (Withdrawn) The method of claim 22, wherein said first access link and said  
2 second access link of said hybrid connection are distinct from access links for a  
3 homogeneous connections between any CE devices operating according to said first  
4 communication protocol.

1           24.   (Withdrawn) The method of claim 22, where said first communication  
2 protocol is Ethernet and said second communication protocol is one of Frame Relay and  
3 ATM.

1           25.   (Withdrawn) The method of claim 22, wherein said second type PDU is an  
2 FR frame or an ATM cell, and said service provider type PDU is an IP packet of an IP  
3 Layer2 Transport type.

1           26.   (Withdrawn) The method of claim 24, wherein step c) comprises:  
2 provisioning the network address of said second CE device at said first PE node;  
3 at said first CE, sending an ARP request to said first PE node for the IP destination  
4 address of said second CE device,  
5 receiving the MAC address of said PE node if said second device is connected to said  
6 second PE node.

1           27.   (Withdrawn) The method of claim 25, wherein said second PE device uses  
2 Inverse ARP capabilities to discover the network address of said second CE device.

1           28.   (Withdrawn) The method of claim 25, wherein said first PE node uses  
2 signaling to provide said first CE device with the network address of said second CE device.

1           29.   (Withdrawn) In a VPL of the type having a plurality of emulated LANs, each  
2 emulated LAN comprising an access link to a service provider edge PE node identified by a  
3 data link connection identifier, a method of establishing a hybrid connection between a first  
4 customer equipment CE device on said VPL and a second CE device that operates according  
5 to a different communication protocol, said method comprising:

6           a) at said second CE device, performing routed encapsulation of traffic into a second  
7 type PDU and transmitting said second type PDU to a second PE node over a second access  
8 link;

9           b) at said second PE node, decapsulating traffic from said second type PDU,  
10 encapsulating the traffic into a subscriber network type PDU and transmitting it over a  
11 dedicated point-to-point tunnel to a first PE node;  
12           c) at said first PE node, decapsulating the traffic received over said dedicated point-  
13 to-point tunnel, encapsulating it into a first-type PDU, and sending first-type PDU to an  
14 access device over a second access link; and  
15           at said access device, bridging said PDU to said first CE device.

1           30.   (Withdrawn) The method of claim 29, wherein said first CE device is an IP  
2 router and said second device is a FR or ATM router.

1           31.   (Withdrawn) The method of claim 30, wherein step c) comprises  
2 sending from said first PE node a proxy ARP request to said first access device over  
3 said first access link;  
4 receiving in a response ARP request the MAC address corresponding to the IP  
5 address of said first-type PDU; and  
6 transmitting said first-type PDU to said first CE device based on said MAC address.

1           32.   (Withdrawn) The method of claim 31, further comprising caching said MAC  
2 address at said first PE node.

1           33.   (Withdrawn) The method of claim 31, wherein if said first CE device is on an  
2 emulated LAN served by said second PE node, said first CE device sends said response ARP  
3 directly to said second PE device.

1           34.   (Withdrawn) The method of claim 29, wherein said first CE device is an IP  
2 router enabled with an IRDP protocol (Internet Control Message Protocol Router Discovery  
3 Protocol) and said second device is a FR or ATM router.

1           35.   (Withdrawn) The method of claim 34, wherein step c) comprises: listening at  
2 said first PE node for advertisement messages issued by said first CE on said first access link;

3 discovering the MAC address of said first CE device and transmitting said first-type PDU to  
4 said first CE device based on said MAC address.

1 36. (Withdrawn) The method of claim 35, further comprising caching said MAC  
2 address at said first PE node.

1 37. (Withdrawn) The method of claim 34, wherein when said MAC address  
2 identifies a non-optimal router, step c) further comprises sending a redirect message to said  
3 second PE with the address of said optimal router so that subsequent PDUs are sent to  
4 optimal router.